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1954 SPRAY SCHEDULES
for Tree Fruits

By W. D. Mills and A. A. LaPlante

Cornell Extension Bulletin

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1954

Spray Schedule for Tree Fruits

W. D. Mills and A. A. LaPlante

The important facts concerning the practical control of orchard diseases and insects by spraying and dusting under New York conditions are given in this bulletin. Only spray schedules based on the latest published and unpublished data of the research workers of the state experiment stations and the authors' observations of practices followed by successful fruit growers are given. It has been prepared after conferences with the members of the experiment stations at Geneva and Ithaca.

APPLES

The most important problems are **apple scab, codling moth, apple maggot, plum curculio, red-banded leaf roller, orchard mites,** and **aphids.** Occasionally, **cedar rusts** are of major importance either locally or generally throughout the region. Other diseases and insects are restricted in importance to more or less definite areas. Because of these variations in importance of the different insects and diseases with locality and year, the following schedule must be considered as a general outline of the spray program to be modified to meet the actual conditions in the orchards to be treated. In counties where the Extension Service conducts a spray-information service, valuable assistance in adapting the general recommendations to individual needs may be obtained on request.

PARATHION AND EPN ON McINTOSH AND ITS RELATIVES

Parathion and EPN are valuable insecticides but may cause injury on McIntosh, Cortland, Kendall, McCoun, Milton, and other varieties of McIntosh parentage.

Parathion

Parathion, when used without charcoal may injure foliage at any recommended dosage if applied during the time of first leaf appearance (green-tip stage) to approximately 2 to 3 weeks after petal fall. The fruit may be injured at any time after the petal-fall stage at dosages higher than ½ pound of 15 per cent wettable powder. Experiments and practical usage have demonstrated the value of correcting this injury by using a

spray grade of activated charcoal. It is suggested that ¾ pound of charcoal be used with each pound of parathion on these sensitive varieties by those growers who desire to use parathion in their schedules. Under extremely favorable conditions, such as in 1953, there may be slight to moderate foliage injury even with the charcoal. The tender leaves on the terminals become blackened on the edges and become "goose-necked." Such injury may occur any year and has been noticeable in one year out of the past four. Increasing the amount of charcoal is not advisable. Fruit injury on McIntosh and Cortland has not been observed where charcoal has been used.

The use of charcoal after the second cover spray is *not* suggested since an undesirable residue results. Experiments show that insecticidal efficiency is not harmed by the addition of charcoal.

EPN

EPN causes fruit and foliage injury similar to parathion. At present there is no known way to correct this injury. Therefore it is recommended *not to use EPN on McIntosh and its relatives.*

SPRAY OUTLINE

FALL AND WINTER APPLICATIONS

Fall and winter sprays of DNC[1] materials are as effective as the use of those products in the spring for the control of **rosy apple aphid and eye-spotted bud moth.** To control rosy aphid with fall applications of these materials, 1½ quarts of the liquid or 1½ pounds of the powder form to make 100 gallons of spray are needed. For control of bud moth, the following are needed, 3 quarts of liquid or 3 pounds of powder in each 100 gallons of water for light to moderate infestations and 4 quarts and 4 pounds respectively for heavy infestations. For best results and for maximum safety to the trees, the sprays are best applied after the leaves have dropped.

Fall applications should not be made until either most of the leaves have fallen from the trees or temperatures of 20° F. or below have been experienced. Observations indicate that egg-laying does not cease until these conditions are met. It has not been fully proved whether fall applications will effectively control oystershell scale, but they may be tried in light infestations.

DNBP[2] materials (Elgetol 318, DN 289) are not recommended for fall applications. They are more injurious than the DN materials previously

[1]DNC contains dinitro ortho cresol. Sold in liquid and powder form in New York State as Elgetol, Krenite, DN Dry Mix No. 2, Dinitro Dry, Ortazol Powder, and the like.
[2]DNBP contains dinitro secondary butyl phenol.

used. Experience indicates that injury may result if fall applications are made.

DNC sprays may be made any time during the winter when temperatures are above freezing and the spray is permitted to dry without freezing. Oil sprays should not be applied until March or April since injury may result.

SPRING APPLICATIONS

Dormant spray

(After the buds have begun to swell but before they show green at the tip)

When control measures are necessary for **rosy, green,** or **apple** aphids, **oystershell scale,** or **bud moth,** the DN, or dinitro, spray materials are recommended.

The recommended quantities for DNC materials in each 100 gallons of spray is as follows:

Aphids require 1½ quarts or pounds for effective control.

Bud moth and oystershell scale require from 3 to 4 quarts or pounds for effective control.

DNC compounds when combined with petroleum oil have caused severe injury in some orchards. It is therefore suggested that the oil be applied separately either after a heavy rain has washed most of the water-soluble DNC from the trees or better still in a green-tip to delayed-dormant spray.

The newer dinitro materials (DNBP) are equally as effective as the older DN materials against aphids, bud moth, and scale insects. These materials are known to growers as DN–289 and Elgetol 318. In addition to being effective against pests controlled by the DNC materials they are also effective against **scurfy scale** and **San José scale.** These materials are effective at lower concentrations than regular dinitros and likewise they may cause serious injury to buds **if used later than the dormant stage** of bud development. Concentrations should be used as follows:

Aphids	1 quart	in	100 gallons
Bud moth	2 quarts	in	100 gallons
*Scale insects	2 quarts	in	100 gallons

*Oystershell scale requires from 3 to 4 quarts.

DNBP materials are also toxic to many of the overwintering eggs of the European red mite. Experience has shown, however, that mite populations built up more rapidly during the summer with DNBP materials as compared with applications of dormant oil. DNBP materials are therefore not recommended as a dormant control for overwintering eggs of the European red mite. Where European red mite populations have been high the past summer or where a heavy deposit of overwintering eggs is

present in the orchard, it is suggested that oil be used preferably in the green-tip or delayed-dormant application as an early red-mite control measure.

It has been the custom to omit aphicides on non-rosy-aphid susceptible varieties, such as McIntosh, Dutchess, and Wealthy. There is some evidence, however, to show that green-aphid control in the summer is made considerably more difficult by this omission. It is therefore advisable to spray all varieties for aphids.

Semi-dormant sprays (silver tip, green tip, and delayed dormant)

Silver-tip stage

(When the blossom buds begin to swell showing silvery tips.)

The first danger of apple-scab infection is on the sepals when the fruit buds are in the silver-tip stage. Sepal infection is occasional in western New York and was general in that area in 1951. Sepal infection is rarer in the Hudson Valley. There were, however, small amounts in the southern end of the Hudson Valley in 1952 and considerably more in 1953. The development of the apple-scab fungus is closely followed in both areas, and the growers are notified if scab spores are mature and if silver-tip or early green-tip infection is possible. Under such circumstances an additional early application of fungicide may be required for scab control in addition to the bordeaux mixture commonly applied in the green-tip or delayed-dormant stage.

Green-tip stage

(When the blossom buds are bursting and show from 1/8 to 1/4 inch of green color)

and

Delayed-dormant stage

(When the leaves of blossom buds are out from 1/4 to 1/2 inch.)

The most important disease to control through this period is **apple scab.** The control of such insects as **European red mite, fruit-tree leaf roller, red bug, scurfy scale,** and **San José scale** may also be obtained at this time with dormant superior oil. Under present-day conditions, however, in New York State fungicide and oil are used principally to control **scab** and **red mite.**

Bordeaux mixture	2–4–100
"Superior" type oil	2 gallons
Blood albumin	2 ounces
Water to make	100 gallons

Best results have been obtained by emulsifying oil sprays in the spray tank. A suitable emulsifier is blood albumin used at the rate of 2 ounces of actual blood albumin to 100 gallons of the spray mixture. Only the blood albumin that is soluble in water should be used. Those that form only a temporary suspension and settle to the bottom after being shaken vigorously in a container of water are unsatisfactory. Suitable commercial brands that contain 2 ounces of actual blood albumin in ½ pound of finished product are available.

Bordeaux mixture is usually added for protection against early scab infection. It is preferable to emulsify the oil with blood albumin and then to add the 2 pounds of powdered copper sulfate and 4 pounds of lime to form the bordeaux mixture rather than to emulsify the oil with the bordeaux mixture.

More than one spray may be required during this period for **apple scab** control. The above formula containing oil and bordeaux mixture should, however, be used only once. It has been shown that **European red mite** control is effective at any time during the green-tip or delayed-dormant period and it is therefore merely a convenience to use the bordeaux-oil formula. Where oil is not used, in other words where additional **scab** treatments are required, one of the following may be applied:

Lime- sulfur ..... 2 gallons

or

Elemental sulfur at manufacturers' directions
Water to make ..... 100 gallons

If a **San José scale** problem exists, the 2 gallons of oil in the bordeaux-oil formula will be enough. If **scurfy scale** is a problem, 3 gallons of oil are needed.

The use of superior oil during this period of tree development is at present considered the most practical control measure against overwintering **European red mite,** because the excessive use of any one insecticide in summer treatments may develop populations of mites resistant to that insecticide.

If a DN spray was omitted or could not be applied for aphid control, BHC may be used at the rate of 2 pounds of a 10 per cent gamma isomer powder or the equivalent in other strengths or lindane at 1 pound of the 25 per cent powder in the bordeaux-oil formula. Best results are obtained at the full delayed-dormant stage; but to prevent injury from the bordeaux-oil formula, spraying should be completed before the leaves roll back and expose the blossom buds. This spray is not so efficient as a dormant DN spray for aphids and is ineffective against **bud moth.**

Combined aphid and bud-moth control may be had with a material called malathion which shows promise for this purpose. It might be used on a trial basis at the rate of 2½ pounds of the 25 per cent wettable powder. Parathion may be used for this purpose in extreme emergency at the rate of 1 pound of 15 per cent wettable powder, but the importance of scab control at this time does not warrant its use. If a ferbam-oil mixture is used rather than a bordeaux-oil mixture, TEPP may be used to control aphids alone. None of these materials controls oyster-shell scale.

A substitute program for superior oil using Ovotran shows promise in New York State tests. This material is also known as Orthotran. Some growers may wish to use, on a trial basis, this material at the rate of ¼ pound in the pink spray and ½ pound in the special curculio or scab spray, the second cover, and the fourth cover. This program also has some value against early two-spotted and four-spotted mites.

Pre-blossom sprays

Elemental sulfur at manufacturers' directions

or

Lime-sulfur	2 gallons
Water to make	100 gallons

The pre-blossom spray or sprays, applied between the delayed-dormant spray and the bloom, are timed primarily for **scab** control. The points to be considered in timing the applications are: the occurrence of rain periods, the amount of new growth, and the stage of development of the scab fungus. In some seasons, two or more pre-blossom applications may be required for effective **scab** control, especially on extremely susceptible varieties such as McIntosh.

Dusting or spraying with elemental sulfurs during rain may be a valuable aid in **scab** control. Both are effective if properly applied. The paste sulfurs are especially valuable for sprays during rain, but the dry wettable sulfurs may also be used. The addition of 1 pound of hydrated lime increases the effectiveness of both forms. An oil type of sticker increases the deposit of sulfur during a rain, but the paste sulfurs give excellent control at from 10 to 12 pounds in 100 gallons of spray without a sticker. Sulfur dusts are effective also during rain, but usually an application must be repeated for protection through the next rain. The finest divided dusts are most effective and the addition of wetters or stickers to the dusts has not been shown to increase effectiveness. The effective use of these materials during rain is discussed in Cornell Extension Bulletin 630, *Efficient*

Use of Sulfur Dusts and Sprays during Rain to Control Apple Scab.

The phenyl mercury compounds (Tag and Puratized) and the napthoquinone compound (Phygon) may also be used in rain or after rain. Both materials give some degree of after-rain control as does lime-sulfur but both are inferior to lime-sulfur or elemental sulfur applied before the rain periods. Lime-sulfur is an excellent protectant and a good after-rain treatment but should not be applied on wet foliage during bloom or during or preceding very high temperatures. Mercury sprays are also dangerous at those times. In past years, the mercury sprays in bloom have apparently caused no injury to foliage, fruit set, or to bees. In 1953, however, serious reduction in set followed bloom sprays of mercury.

Post-bloom sprays of mercury preceding or during hot weather have caused leaf injury and drop, and in some instances fruit drop as well. Mercury should not be used after the petal-fall spray. Phygon in a seasonal schedule has caused a serious reduction in bloom and fruit set the following year. Its use should be limited to occasional pre-cover sprays at low dosages.

Ferbam is safe on apple foliage but caused considerable enlargement of fruit lenticels and some russeting during 1951, 1952, and 1953. Ferbam is inferior to sulfur paste as a protectant against leaf scab but at 1½ pounds per hundred gallons equals 5 pounds of sulfur in control of fruit scab. Ferbam also showed some after-rain control of scab in 1953 but cannot be relied upon for this purpose.

On red and Golden Delicious, captan (Captan 50W and Orthocide 406) has usually given higher finish than any other fungicide for the past three years. The use of methoxychlor in the curculio sprays and DDT in the cover sprays along with a captan program appears to be the most promising combination on these varieties.

In 1953 serious fruit russet on Delicious and Stayman was reported in the Hudson Valley from captan at 4X. Considerable leaf spotting of (red) Delicious and Baldwin again appeared in 1953 soon after the petal-fall stage, following pre-bloom and bloom sprays of captan. This injury by captan was more severe on red Delicious trees receiving a bordeaux-oil spray in the green-tip or delayed-dormant spray. In most instances the leaf injury to red Delicious and Baldwin was not serious. Captan possesses some after-rain effect against scab infection but cannot be relied upon more than 18 hours from the beginning of the rain.

Glyodin (Crag 341) was an effective protectant against apple scab, at 1 quart per 100 gallons during primary scab, and from 1 to 1½ pints later. 341 should not be used on apples in New York State at the rate of

more than 1 quart per 100 gallons. Some late leaf injury appeared on Rhode Island Greening, Baldwin, and Cortlands sprayed with glyodin and lead arsenate. The spotting was late in the summer and did not appear to be important. Glyodin and DDT combinations did not cause the leaf spotting. The mixture of 1 pint of 341 with half strength mercury has given excellent control when combined protection and after-rain control were needed. This mixture has caused no injury to foliage or fruit in pre-cover sprays during the past five years.

Dithane D-14 (1½ pints) plus ferric sulfate (4 ounces) with or without 3 pounds of sulfur caused some leaf injury on Rome in 1953 when used with lead. Dithane Z-78 produced better fruit finish than D-14 plus iron on McIntosh and Rhode Island Greenings. Foliage of these varieties showed a yellowish cast both in New York and in the Shenandoah Valley. Scab control in the New York plots visited was good with both dithane materials, but in some other states both fell down badly in scab control.

For eradication of leaf scab, DN Dry-Mix No. 2, (½-100), with lime, (3-100) and a spreader gave as good results in 1953 as in 1952, when thoroughly applied before the lesions began to cork off. Two applications may be necessary, depending upon the stage of scab development and overlapping infection periods. This mixture is probably safest when used with a wettable sulfur. It is ineffective with Crag 341. It should not be applied during hot weather (more than 75° F.) or if hot weather is likely to follow. DN Dry-Mix No. 2[3] is safer to use after bloom than before. There is little information on what might be expected on varieties other than McIntosh.

If chewing insects, such as **fruit tree leaf roller, green fruitworms, tent caterpillars, cankerworms,** present a serious threat to the foliage or buds, 2 pounds of 50 per cent wettable DDT powder may be included in the pre-blossom spray. Generally, unless the threat is serious, it is advisable to postpone the use of DDT until petal-fall spray to reduce possible danger to pollinating insects. *Lead arsenate should not be used in this spray* because it poisons pollinating insects. If an insecticide is to be used in this spray, honeybees must be removed from the neighborhood.

Special bloom spray

(When three-fourths of the blooms are open in orchards where ***fire blight*** *is a problem)*

Copper sulfate	2 pounds
Hydrated lime	6 pounds
Water to make	100 gallons

or

20–80 copper-lime dust

[3]DN No. 2 = 40 per cent dinitro-o-cresol.

One application is usually made when three-fourths of the blooms are open but, if the disease has been very severe, an additional early application may be made when about one-fifth of the blossoms are open. The possibility of a reduction of the set of fruit and of fruit russeting by applications of copper during bloom should be balanced against the likelihood of blossom infection in deciding whether to apply the material in individual orchards.

The phenyl mercury sprays have been used in earlier limited tests in New York with some control of blight and with no apparent reduction of fruit set. With a reduction in set up to 50 per cent, which occurred in 1953 with mercury sprays in bloom, bloom sprays of mercury in 1954 are not suggested.

Dithane Z-78, at 2 pounds per 100 gallons, has been reported favorably for fire-blight control in bloom sprays in several states. In limited New York experiments there has been no blight to test its efficiency.

Certain antibiotics appear extremely effective in fire-blight control and may replace present materials if the antibiotics can be made available at a reasonable cost.

The spray application is supplementary to such measures as chemical treatment or cutting out of cankers, pruning out blighted branches and suckers, and breaking off blighted fruit-spurs.

Bloom sprays and dusts of elemental sulfur may be of considerable value in orchards where cedar rusts are a problem and where eradication of the red cedar is impracticable.

Ferbam has been shown in Hudson Valley experiments to be much more efficient than sulfur in the control of **cedar rusts.** Where the rusts are serious in the Hudson Valley, ½ pound of this organic compound, with 3 pounds of elemental sulfur in 100 gallons of spray, is suggested for the pre-bloom spray, in a bloom spray, and in the petal-fall and curculio sprays.

In orchards that received the pre-blossom spray some time in advance of the opening of the blossoms or where the pre-blossom spray was omitted, or in seasons when the bloom period is unusually long and rainy, bloom applications of elemental sulfur may be valuable aids in scab control. Yield, however, may be reduced by these bloom applications, and their use is justified only when the amount of bloom and pollinating conditions are adequate and a disease problem exists. *Insecticides should not be included in any bloom application.*

Figure 1. Proper stage to apply green-tip spray

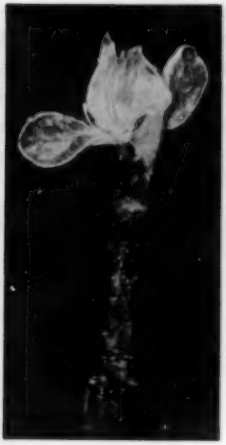

Figure 2. Proper stage to apply delayed-dormant spray

Figure 3. Pre-blossom, earliest stage when only one spray is applied

Figure 4. Pre-blossom, ideal stage to spray if weather permits

Figure 5. Proper stage to apply petal-fall spray

Petal-fall spray

(When the last of the petals are falling)

Before you apply a petal-fall spray, remove honeybees from the orchard and place them at least one mile away.

Lime-sulfur	2 gallons
or	
Elemental sulfur (actual sulfur)	5 pounds
Lead arsenate	3 pounds
Hydrated lime	3 pounds
Water to make	100 gallons

Other fungicides which may be used in place of sulfur in the schedule above are captan 2 pounds, ferbam 1½ pounds, and glyodin 1 quart. These organic fungicides are discussed on page 9.

The lead arsenate formula often gives adequate protection against **plum curculio** in most western New York orchards except for early varieties, such as Dutchess. The hydrated lime is included as a protection against arsenical injury but may be omitted where ferbam fungicides are used. If the dormant oil is omitted, 2 pounds of DDT may be included where **scurfy scale, oystershell scale, San José scale, fruit-tree leafroller** or **red bug** are of importance, and the concentration of lead arsenate and lime may be dropped to 2 pounds of each. The combination of DDT and lead arsenate affords more protection against plum curculio than does lead arsenate alone. Both lead arsenate alone and the combination of lead arsenate and DDT are of little value against **red-banded leaf roller** in seasons of severe first-brood attack, such as 1951, and should be bolstered with DDD (also called *TDE)* in either the petal-fall spray or the curculio spray at the rate of 1 pound of 50 per cent powder.

The use of parathion on non-McIntosh varieties at the rate of 2 pounds of 15 per cent powder in 100 gallons of spray mixture when used in the petal-fall and the curculio sprays in both eastern and western New York and in the first cover spray in eastern New York gives protection in many orchards against **plum curculio, red banded leaf roller** and, **European red mite.** Other pests controlled in these sprays are **red bug, fruit-tree leaf roller, tarnished plant bug,** and **oystershell scale.** If parathion is used, an aphicide will be required in the dormant or delayed dormant sprays and further insecticidal treatments should not be necessary until the petal-fall spray, provided resistance to parathion by the **European red mite** is not a problem. If resistance is a problem, the oil spray is suggested in addition. Its use on McIntosh variety and its relatives is referred to in the note on page 3.

In a cooperative experiment in New York in 1952 under conditions favorable for apple-scab infection, the use of parathion allowed significantly more scab to develop in combination with seven fungicides than where parathion was not used. Similar increases in scab with parathion have been reported from West Virginia, Virginia, and Michigan.

In a tree response experiment in western New York on McIntosh and Rome varieties, parathion in combination with four fungicides had no significant effect on yields as compared with lead arsenate. There was almost no scab in any of the plots. In grower-sprayed demonstrations in New York State in 1953, leaf scab was increased in four orchards by parathion. In the other six orchards where scab was low or absent, there was no difference in leaf scab on the trees receiving parathion and on those that received no parathion. The summer of 1953 was unusually dry and there was no comparable increase in fruit scab with parathion in the orchards showing increases in leaf scab. Fruit-set counts in all orchards showed a small but significant decrease in fruit set (about 10 per cent) with parathion on both McIntosh and Cortland. More experiments are needed to ascertain the possible effect of parathion in years of light bloom and light fruit set.

It is not certain at this time whether the increases in scab and reduction in fruit set under New York conditions will be serious.

Growers who use parathion should make every effort to conduct an intensive scab-control program. If adequate measures are taken, effective scab control is possible. The most serious danger, as indicated by experience, appears to be when a serious scab-infection period corresponds with a parathion spray or an appreciable number of scab lesions are already present. It would be well to use other insecticides rather than the parathion under these circumstances.

Where control of plum curculio alone is desired either methoxychlor at the rate of 3 pounds of the 50 per cent wettable powder or dieldrin at the rate of ½ pound of the 50 per cent powder, may be substituted for the lead arsenate in the formula. Both of these materials are much more efficient for this purpose than lead arsenate in heavy infestations. It is necessary to add DDD for red-banded leaf roller control, and in the Hudson Valley area DDT should be added to the dieldrin in the first cover spray for protection against the codling moth. Methoxychlor is safer than DDT to warm-blooded animals, but persons using dieldrin should follow the same precautions for safety recommended for the phosphorous-containing insecticides such as TEPP, parathion, and EPN.

To control European apple sawfly in the Hudson Valley area, either

parathion or BHC is recommended. A thorough application at petal fall is usually enough. BHC at the rate of 2 pounds of 10 per cent powder may be added to other materials, such as lead arsenate, lead-DDT mixture, methoxychlor, or dieldrin. Parathion may be used alone or with activated carbon. It will probably be necessary to add fungicide to any of the above.

If wet weather prevails during bloom and if **scab** control is doubtful, or if scab spots are present on the leaves, lime-sulfur may be used. With dry weather during bloom and no scab present, elemental sulfur or one of the organic fungicides listed, is preferred for the petal-fall spray to lessen the danger of spray injury and of reduction in yield by lime-sulfur.

If conditions are favorable for a heavy infection of **scab,** one should spray as much as possible and use dust as a supplementary measure.

Curculio or special scab spray

(From 1 to 2 weeks after the petal-fall spray)

325 mesh sulfur	5 pounds
or	
Organic fungicides at manufacturers' directions	
Lead arsenate	3 pounds
DDD	1 pound
Hydrated lime	3 pounds
Water to make	100 gallons

In New York this spray is normally the most important single spray for **plum curculio** but it is equally important for the control of **apple scab.**

The spray is timed from 7 to 10 days after petal fall in eastern New York, primarily for plum curculio. The choice of the interval is based upon the temperature at that time and to some extent on rainfall and fruit growth. Temperatures of more than 75° F. for several successive days after the fruit has formed are most favorable for curculio attack. If the fruit is well covered prior to a warm period, control should be excellent. If very cool weather prevails, the longer interval would be the more practical. Excessive rainfall will smooth out a spray deposit, thus making it insecticidally less efficient, and a very rapid fruit growth will reduce the deposit. Under either of these conditions, the shorter interval would be desirable.

The lead arsenate and DDD (TDE) formula should be used in areas or orchards where plum curculio is not a serious threat. Hydrated lime is a corrective for arsenical injury and should be omitted where ferbam fungicides are used.

The DDD (TDE) is needed to control **red-banded leaf roller** if not al-

ready used in the petal-fall spray. The spray should be directed to the undersides of the leaves. Some advantage in curculio control may be gained by adding 2 pounds of DDT to the formula and reducing the lead arsenate to 2 pounds. It is felt, however, that where the curculio problem is serious enough to require an additional insecticide, it would be more advisable to use either parathion methoxychlor or dieldrin rather than the mixture of lead arsenate and DDT.

The discussion under petal-fall spray concerning parathion, methoxychlor and dieldrin (page 13) applies here. The most practical schedule for insect and mite control is the use of parathion at the rate of 2 pounds in 100 gallons of spray mixtures. Details concerning use of this material on McIntosh and its relatives are given on page 3.

In western New York orchards in many seasons, a special spray, applied about two weeks after the petal-fall spray, may be required to control **apple scab.**

The same considerations exist as in the petal-fall application with respect to the choice of elemental sulfurs or liquid lime-sulfur in this application.

SUMMER SPRAYS

The purpose of the summer sprays is to control **codling moth, apple maggot, red-banded leaf roller,** and **apple scab. Orchard mites** and the **green apple aphid** may also become problems.

It is usual to include a fungicide in all summer sprays for scab control. The micro-fine paste and air-ground sulfurs cause fruit scald too frequently to be advised in summer sprays. In most years the coarser 325-mesh elemental sulfur can be substituted to reduce the danger of spray injury. In both 1952 and 1953, however, temperatures were so high that the 325-mesh sulfurs also caused injury. One of the organic fungicides discussed on page 11 may be substituted at somewhat higher cost when high temperatures are forecast. In the cover sprays if scab control is good, captan and ferbam may be reduced to 1 pound and glyodin to 1½ pints per 100 gallons.

The summer-spray program of sulfur and lead arsenate usually controls **Brooks fruit-spot.** Small amounts of this disease appeared on susceptible varieties of apples in the Hudson Valley in 1947. In this area 1 pound of ferbam may be substituted for the sulfur when lead arsenate is not used.

In planning a spraying schedule for the summer application — that is, after the petal-fall or the curculio spray — it must be kept in mind that the regulations of the Federal Food and Drug Administration do not

permit excessive amounts of spray residue on the fruit at harvest time. The present tolerances permitted on apples and pears are 0.05 grain of DDT, 0.025 grain of arsenic trioxide, and 0.05 grain of lead for each pound of fruit. The tolerances on fruits other than apples and pears are 0.01 grain of arsenic trioxide and 0.025 grain of lead for each pound of fruit. The equivalent unofficial tolerances for apples and pears expressed in parts per million (p.p.m.) would be 7 p.p.m. of DDT, 3.5 p.p.m. of arsenic trioxide, and 7 p.p.m. of lead. For fruits other than apples and pears, the unofficial tolerances would be 1.5 p.p.m. of arsenic trioxide and 3.5 p.p.m. of lead. These tentative tolerances should not be exceeded in a normal season, provided the schedules outlined in this bulletin are followed.

The basic summer schedule follows. Suggested spray dates may be somewhat earlier in eastern New York and later in western New York than those indicated.

First codling-moth cover spray

(About June 10 to 15)

325 mesh sulfur ..... 5 pounds

or

Organic fungicide at manufacturers' directions

*DDT (50 per cent powder) ..... 2 pounds

Water to make ..... 100 gallons

*If you use 75 per cent DDT powder, reduce the dosage to 1⅓ or 1¼ pounds.

The first codling-moth cover spray is timed primarily to control codling moth. DDT should be used as a basic schedule in orchards with a moderate to heavy infestation. The orchardist who has had little difficulty with codling moth in the past may use 3 pounds of lead arsenate and an equal quantity of hydrated lime as a corrective in the basic schedule. The hydrated lime should be omitted where ferbam is used.

In eastern New York orchards, an insecticide with the DDT for **plum curculio** should be included in this spray as discussed for the petal-fall spray. If parathion or methoxychlor is used, the DDT may be omitted.

For efficient control of both codling moth and mites, a mixture of 1½ pounds of 50 per cent DDT and ½ pound of parathion plus fungicide in 100 gallons of spray may be tried. This program if followed through all cover sprays, including the second-brood codling moth sprays, controls codling moth equally as well as does DDT alone. Special measures should not be required to control orchard mites and the red-banded leaf roller. It is available as a commercially formulated material (Black Leaf 253).

Caution: In a 1952 experiment this combination was ineffective against apple maggot and therefore should not be used without the addition of lead arsenate where this insect is a problem. There is also evidence that the continued use of parathion in all the cover sprays may result in resistant mite populations after several years of use.

Second codling-moth cover spray or first apple-maggot spray
(About June 20 to 28)

325 mesh sulfur	5 pounds
or	
Organic fungicides at manufacturers' directions	
*DDT (50 per cent wettable powder)	2 pounds
Water to make	100 gallons

*If you use 75 per cent DDT powder, reduce the dosage to 1⅓ or 1¼ pounds.

This spray is applied from 10 to 14 days after the first cover spray, depending upon the severity of the **codling-moth** infestation. In recent years the spray has been necessary to control apple maggot.

Evidence indicates that DDT, although effective for intervals of 10 to 14 days against the codling moth, depending upon activity, loses its toxicity to the **apple maggot fly** after approximately 10 days under average summer conditions. Where orchards are surrounded by woods or hedgerows or are within several hundred feet of unsprayed apples and apple maggot is a problem, the spray interval should not exceed 10 days where DDT alone is used. As a practical measure in lengthening the interval, a combination of lead arsenate, DDT, and lime, 2 pounds of each in 100 gallons of spray mixture, may be used at intervals of 12 to 14 days without sacrificing control of the apple maggot. You may use this mixture until about July 20 in eastern New York and until near August 1 in western New York without exceeding residue tolerances on varieties such as McIntosh and Cortland and is recommended where apple maggot is a serious problem.

One should examine the trees carefully before applying this and following sprays, to determine whether **European red mites** or **two-spotted spider mites** are building up. If there are from 4 to 6 mites on leaves in June, July, or early August, one should apply tetraethyl pyrophosphate (TEPP) at manufacturers' directions, either added to the spray mixture or supplied as a separate spray. Parathion at 1 pound of 15 per cent wettable powder or EPN at the rate of ½ pound in 100 gallons of spray mixture may be used. The EPN kills mites over a longer period than either

parathion or TEPP but the killing action is slow at first. EPN is injurious to foliage and fruit of McIntosh and is relatives. At present there is no way to correct the injury and it is therefore not recommended on these varieties. Two sprays are generally necessary with all these materials because they are not very toxic to the eggs. They should be applied at a 7- to 10-day interval; the shorter interval during periods of warm temperature and the longer interval during cooler temperatures. Do not use TEPP with bordeaux mixture or lime. If resistant mite populations develop after the extensive use of any of the above materials, Aramite (1½ pounds per 100 gallons of spray), Dimite (1 pint to 100 gallons of spray) or Ovotran (½ pound to 100 gallons of spray) may be used on a trial basis.

If parathion was used in the petal-fall and curculio sprays or dormant oil was used, special summer treatments to control European red mite are not needed except in unusual seasons or where mites have escaped earlier treatments due to poor coverage. Infestations of **two-spotted** or **four-spotted** mites seldom begin to build up in fruit trees before August but may continue to build up through harvest time. The same control measures suggested for European red mites are useful for two-spotted mites, but two applications may not be enough.

Tetraethyl pyrophosphate at manufacturers' directions or parathion at 1 to 2 pounds of 15 per cent powder, may be included as a summer control for **green apple aphids** when they appear.

Malathion at the rate 1 to 2 pounds to 100 gallons of spray may be used on a trial basis. It is also suggested a dormant or delayed-dormant treatment be included in the program as discussed on page 5. The use of summer oils with DDT may burn the foliage and greatly increase toxic residue at harvest time.

If **scab** is under control, a fungicide may not be needed in this spray. Where lead arsenate is to be used in the third cover spray and scab is under control after the first cover spray, the fungicide may be omitted in some of the other cover sprays; the omission is advisable during or preceding periods of extreme heat. Some growers prefer to use a 2–8–100 bordeaux mixture as the fungicide in this and later sprays. This mixture is superior to proprietary copper sprays in scab control, and helps to reduce arsenical injury. The bordeaux should be reduced to a ¾–3–100 concentration where scab control is not needed but arsenical injury is a problem. The use on apples of any copper compound now known is attended with some danger of injury to foliage and fruit in this State. The most dangerous period is from the delayed-dormant spray through the first cover spray. Any of the later sprays also may be injurious. It may be best also to lengthen the interval between applications from 12 days to 14 days.

Third codling-moth cover spray or second apple-maggot spray

(About June 30 to July 10)

Same as second codling-moth cover (page 18).

If **apple scab** is not a problem, you may omit the fungicide from this spray. Watch the orchard carefully for **mites** and, if a problem, follow the suggestions in the second codling-moth cover spray.

Fourth codling-moth cover spray or third apple-maggot spray

(About July 10 to 18)

Same as second codling-moth cover spray (page 18).

This spray is effective for the control of **codling moth** and **apple maggot.** It may not always be needed to control codling moth, depending on the seasonal development of this insect. When DDT is used for the control of **apple maggot,** it would be advisable to add from 2 to 3 pounds of lead arsenate plus 2 pounds of lime to extend the effectiveness of this spray. If first-brood codling moth activity has diminished, the DDT may be omitted. Apple maggot is normally at the peak of its activity through this period. If a mite infestation is present, the suggestions made under the second codling-moth cover spray concerning the presence and control of mites (page 18) should be followed.

For a spreader at this time ¼ pound of skimmilk powder or ½ pound of soybean flour may be used with the lead-arsenate program. Where arsenical injury is a problem, 2 pounds of hydrated lime may be added for each pound of lead arsenate. A ¾–3–100 bordeaux mixture is more effective in this respect than is lime alone.

The nicotine compounds, parathion and TEPP, apparently are not effective against apple maggot. To control apple maggot satisfactorily, all trees in infested orchards should be thoroughly sprayed. This applies not only to apple trees in their off-bearing year, but also to other fruits interplanted with apples. Experience has shown that failures to control the apple maggot are especially likely to result if spraying is confined to trees with fruit. Hedgerows, neglected orchards, and scattered trees near and adjoining commercial plantings should also receive the maggot sprays.

Second brood codling-moth and red-banded leaf roller cover sprays

(First three weeks in August)

Fungicide at manufacturers' directions	
DDD (TDE) (50 per cent wettable powder)	2 pounds
Water to make	100 gallons

This spray is applied about August 1 in eastern New York and about August 7 in western New York. This provides protection against **red-banded leaf roller, codling moth,** and **apple maggot.** It is important to direct this spray to the underside of the leaves or it will be ineffective against red-banded leaf roller. DDD offers no protection against orchard mites. If the two-spotted mite is a problem at this time of year, the recommendation on page 18 under the second codling moth cover spray should be followed.

Parathion may be substituted for the DDD at the rate of 1½ pounds in 100 gallons of spray mixture subject to the restrictions noted on page 3. Parathion provides protection against red-banded leaf roller, codling moth, and orchard mites but its efficiency against apple maggot does not extend beyond 3 to 5 days according to present information. Therefore, it does not seem wise or practical to use this material in areas troubled with the apple maggot.

The combination of 1½ pounds of 50 per cent DDT and ½ pound of parathion may be substituted for the DDD in the above mixture provided another spray treatment is made in 10 to 12 days. Good control of second-brood codling moth and reasonable control of orchard mites will be obtained and somewhat poorer control of red-banded leaf roller will result than if the DDD were used. This combination has not been effective against the apple maggot and is not advised in areas where this pest is a problem, particularly in the Hudson Valley area.

Lead arsenate, 3 pounds in 100 gallons of spray mixture plus 3 pounds of lime, may be substituted for the DDD in the above formula but it should be used only in orchards where it has been used in the past with relatively good results. The use of lead arsenate in August creates excessive residues on earlier varieties such as McIntosh and Cortland.

DDT may be substituted for the DDD in the above formula where red-banded leaf roller is not a problem for control of codling moth and apple maggot.

Special sprays

In some years late activity of **codling moth, apple maggot,** or **orchard mites** requires special treatment during August. These treatments become increasingly uneconomical as the season progresses and should be made only when absolutely necessary. The local county agricultural agent or Spray Information Service Letters where available tell when these sprays are necessary.

At this time of year excessive residues are as important to prevent as is insect damage. The most practical material to use on most varieties is

methoxychlor at the rate of 2 pounds in 100 gallons of water where late codling moth or apple maggot are to be controlled. A treatment should be made between August 10 and 20. One or two applications of 5 per cent DDT dust serves the same purpose. If red-banded leaf roller still persists due to faulty coverage, the DDD formula may be repeated on varieties harvested later than Cortland.

DUSTING FOR APPLE SCAB

For scab control, experimental work shows sulfur dusts are most effective when applied during rain before infection occurs. The finer divided dusts are more adherent than the coarser forms. For this reason, the grower should insist on a dusting sulfur equal in fineness to the dry wettable sulfur even if the cost is higher.

PEAR

A PRACTICAL spray schedule for pears in New York must be built around the control measures required for **pear psylla**, for this pest is by far the most serious of any to the pear crop. The **pear tarnished plant bug, pear midge, stink bug, fruit-tree leaf roller, green fruit-worms, sinuate pear borer, rose leaf beetle,** and **quince curculio** cause damage in some orchards. The most important disease of pears is **fire blight,** but **pear scab, sooty blotch, leaf spot,** and **Fabraea leaf-blight** and **fruit spot** are important in some orchards. The spray schedule includes sprays for all these. All growers do not have to apply all of the sprays. The grower should, therefore, select from the schedule those sprays needed to protect his particular orchard.

SPRAY OUTLINE

The choice of control measures for **pear psylla** depends upon the availability of materials and upon the experience of the individual grower as to other insect problems in his orchard. A basic schedule consists of a "late dormant" application followed by one or more of the later sprays if necessary.

SPRING APPLICATIONS

Dormant spray

(When the buds are not yet showing green)

Superior dormant oil	3 gallons
*Blood albumin (actual)	2 ounces
Water to make	100 gallons

*Directions for tank mixing are on page 7.

This treatment is made where **pear leaf blister mite** is troublesome.

One pint of nicotine sulfate is added to the oil or used separately if **pear thrips** are a problem. The application is made when the thrips are "swarming" on the opening buds.

Late dormant spray

(From the stage when blossom bud scales are loosened until green leaf tips are showing)

Elgetol, Krenite, or Dinitrosol (DNC materials), 1 gallon in 100 gallons of spray, applied in the green-tip stage controls both **pear psylla** and **sooty blotch.** If sooty blotch is not a problem, either 2 quarts or 2 pounds of a DNC material may be used in this spray to kill **pear-psylla** eggs. The new DNBP materials (DN–289 or Elgetol–318) may be used against psylla eggs at a concentration of 2 quarts to 100 gallons of spray mixture.

Parathion may be used at 1 to 1½ pounds or EPN at ¾ pound in 100 gallons of spray mixture to kill pear psylla eggs at this time in place of the DN materials. Parathion and EPN appear to be less injurious to the trees and also allow somewhat more leeway in timing the treatment than do the DN materials. These materials are probably not effective against **sooty blotch.**

Pre-blossom spray

(When the blossom buds begin to separate in the cluster)

A pre-blossom application is necessary only in orchards where **pear scab** or **pear midge** is a problem. For **scab** control, lime-sulfur 1–50 (2 gallons in 100 gallons of water) or a 2–10–100 bordeaux mixture may be used.

Pear scab caused serious loss in several western New York pear orchards in 1952. In these orchards, a ground spray was very effective when applied in the spring of 1953. Pear scab was serious in some pear orchards in 1953. A number of orchards received a thorough ground spray of 400 to 600 gallons per acre of a spray containing 2 quarts of paste DNC in each 100 gallons. The spray was applied in the spring of 1953 while the trees were still dormant. The grower than applied the pre-blossom spray and obtained excellent scab control despite complete crop losses from scab in 1952. The ground spray is best applied in the dormant period but may be applied through the green-tip stage. Further discussion of ground sprays are given in Extension Bulletin 711. Nine years experiments with ground sprays for apple scab control are discussed in New York State (Geneva) Agricultural Experiment Station Bulletin 714, *Ground Treatments as an Aid in Apple Scab Control.*

The most effective control for **pear midge** is 2 pounds of DDT powder to 100 gallons of spray applied when the blossom buds are swollen but before the sepals have begun to separate and again 7 days later. At this time the midge flies are usually "swarming" on the trunks and will readily take flight if disturbed. If a fungicide is necessary, elemental sulfur may be used.

Special bloom spray

(When three-fourths of the blooms are open in orchards where ***fire blight*** *is a problem)*

Copper sulfate	2 pounds
Hydrated lime	6 pounds
Water to make	100 gallons

or

20–80 copper-lime dust

One application usually is made when three-fourths of the blooms are open; if **fire blight** has been very severe, you may make an additional early application when about one-fifth of the blossoms are open. The possibility of a reduction of the set of fruit and of fruit russeting by copper applications in bloom should be balanced against the likelihood of blossom infection in deciding whether to apply the material in individual orchards. (See special bloom spray for apple, page 11).

The spray application is supplementary to such measures as cutting out or chemical treatment of cankers, pruning out blighted branches and suckers, and breaking off blighted fruit spurs. These control measures are discussed in detail in Cornell Extension Bulletin 405, *Fire Blight and Its Control.*

Petal-fall spray

(When the last of the petals are falling)

Elemental sulfur at manufacturers' directions	
Parathion	1 to 2 pounds
Water to make	100 gallons

The parathion in the formula is effective against **false tarnished plant bug, fruit tree leaf roller, green fruit worms,** and **plum curculio.** DDT, lead arsenate, and lime, 2 pounds of each, may be used for control of the pests mentioned. In orchards where pear psylla is the only problem, this spray may be omitted.

Bordeaux mixture, 2–10–100, may be used in place of the elemental sulfur to control **pear scab,** and nicotine sulfate, 1 pint in 100 gallons of spray, may be used with bordeaux to control **false tarnished plant bug.** Lead arsenate, DDT, or parathion may be used with the bordeaux. Parathion may injure the foliage on the Bosc variety in some locations and in some years and should be used cautiously on this variety.

Insecticides should not be used on open blossoms.

First-nymph spray

(About a week to 10 days after the petals have fallen)

Elemental sulfur at manufacturers' directions
Parathion ..... 1 to 2 pounds
Water to make ..... 100 gallons

This spray is made especially for **pear psylla,** but also furnishes protection against **plum curculio** and **pear scab.** Any one of the formulas listed under early summer sprays may be used where **pear psylla** alone is a problem.

Special spray for rose leaf beetle, quince curculio, and sinuate pear borer
(About June 10; usually necessary only in eastern New York orchards wherever these pests may be a problem)

Lead arsenate ..... 3 pounds
Hydrated lime ..... 3 pounds
Spreader ..... ½ pound
Water to make ..... 100 gallons

If **sinuate pear borer** is a problem, the lead arsenate and lime are increased to 5 pounds each, or 2 pounds of *DDT* is added to the spray mixture.

SUMMER SPRAYS

*(When **psylla** or **codling moth** becomes threatening)*

Early summer sprays

(In July when most of the second-brood psylla eggs have hatched)

At this time any one of three mixtures may be used for **pear psylla:**

1. Parathion (15 per cent wettable powder) 1 pound
   Water to make ..... 100 gallons
2. Cubé root (5 per cent rotenone) ..... 2 pounds
   Summer oil ..... 2 quarts
   Blood albumin emulsifier ..... 2 ounces
   Water to make ..... 100 gallons
3. EPN ..... ½ pound
   Water to make ..... 100 gallons

Elemental sulfur may be added to formula 1 or 3 where **pear scab** is a problem.

Excellent control of **sooty blotch** and of **Fabraea leaf and fruit spot** may be obtained by the use of 1 pound of ferric dimethyldithiocarbamate (ferbam) to 100 gallons in the summer sprays.

If **codling moth** is a problem, formula 1 or 3 is recommended.

Late summer spray

(Early in August if psylla becomes abundant and threatens to smut the fruit or if the second-brood codling moth is a problem)

In areas of New York where **codling moth** is troublesome, late injury may be prevented by using a mixture of 1 pound of 50 per cent DDT and 1 pound of parathion. Where codling moth is not a problem, the DDT is omitted, If DDT is omitted any of the formulas given under early summer sprays may be repeated at this time if necessary for **psylla.** The spray usually is applied during the first two weeks of August.

CHERRY

UNDER New York conditions, cherries are sprayed principally to control **leaf spot, brown rot,** and **fruit flies.** In some locations the **plum curculio** may require attention. **Black cherry aphid** is confined as a pest mostly to sweet cherries.

SPRAY OUTLINE

FOR SOUR CHERRIES

Pre-blossom spray for sour cherries

(Just before the blossoms open)

Lime-sulfur	2½ gallons
or	
Elemental sulfur (actual sulfur)	5 pounds
or	
Captan	2 pounds
Water to make	100 gallons

This spray is applied for the control of **brown-rot blossom-blight.** It is important in most seasons on English Morello, and may be needed in some years on Montmorency cherries. Promising results were obtained with captan against brown rot blossom blight in sweet cherries.

Petal-fall spray for sour cherries

(When the last of the petals ar falling)

Low-soluble copper at manufacturers' directions plus 1 pound of lime for each ¼ pound of metallic copper in the mixture plus 1 pint of oil type sticker. Lead arsenate, *2½ pounds in 100 gallons of spray, is included.

or

Elemental-sulfur paste	10 pounds
Oil type of sticker	1 pint
Hydrated spray lime	2½ pounds
*Lead arsenate	2½ pounds
Water to make	100 gallons

or

Lime-sulfur	2½ gallons
*Lead arsenate	2½ pounds
Water to make	100 gallons

or

Glyodin (341)	1½ pints
*Lead arsenate	2½ pounds
Lime	2½ pounds
Water to make	100 gallons

or

Ferbam	1½ pounds
*Lead arsenate	2½ pounds
Water to make	100 gallons

*Lead arsenate should be reduced to 1 pound on English Morellos to reduce arsenical injury ("dry stem").

Stem-end injury to Montmorency fruit, in the form of a black ring, appeared in appreciable amounts in a few orchards that received sprays of low-soluble copper in 1945. Apparently injury is more likely when the copper is used in the shuck and the first fruit-fly spray. There was no injury in the six previous years from the use of these materials, and leaf-spot control was superior to that with the sulfur sprays. Two organic fungicides that have shown promise as substitutes for low-soluble copper in the shuck and first fruit-fly sprays to prevent fruit injury are heptadecylglyoxaldine (341) at 1½ pints per hundred gallons and ferric dimethyldithiocarbamate (ferbam) used at 1½ pounds per hundred gallons of spray.

Either 341 or ferbam used in shuck-fall and first-fruit-fly sprays prevents stem-end injury to fruit caused by fixed coppers but will not prevent arsenical dry stem. The use of one or more sulfur sprays in July reduced dry stem in English Morello cherries in 1950. Lime should be used in all cherry sprays in orchards that receive lead arsenate in fruit-fly sprays.

Crag 341, the glyoxalidine solution, at 1½ pints to 100 gallons of spray mixture controlled leaf spot and did not injure sour cherries in 1951. Higher dosages reduced the sugar content in 1950 and 1951.

The addition of ½ pound of soybean flour improves the spreading qualities of the lime–lead-arsenate mixture. Parathion or methoxychlor may be used in place of lead arsenate where curculio is a severe problem as discussed in the plum schedule on page 37. Elemental sulfur should be used with these materials.

This spray is effective against **leaf spot, brown rot,** and **curculio.**

Bordeaux mixture at 1½–6–100 may also be used, but this highly effective fungicide may injure the foliage and dwarf the fruit. Dwarfing of the fruit has followed lime-sulfur applications also. During a four-year test, higher yields were obtained with low-soluble copper and with sulfur paste than with lime-sulfur or bordeaux mixture.

For the grower who uses a dusting schedule, a 90–10 sulfur–lead-arsenate mixture is indicated. If **curculio** is abundant, an 80–20 mixture of the same materials may be used.

Shuck spray for sour cherries

(When the shucks are falling from the fruits that are going to set)

The same suggestions and materials as those mentioned under petal-fall spray apply to the shuck spray.

This spray is effective against **curculio, leaf spot,** and **brown rot.**

For dust, an 80–20 sulfur–lead-arsenate mixture is indicated.

Later sprays for sour cherries

These later sprays are for **cherry fruit flies, leaf spot,** and **brown rot.**

For canning cherries to be washed

First fruit-fly spray for sour cherries

*(A week after the **fruit flies** have first appeared or about the time Early Richmond first shows a tinge of color)*

The materials and suggestions are the same as those given under the petal-fall spray (page 26).

Second fruit-fly spray for sour cherries

*(About 10 days later than the first **fruit-fly** spray or when Montmorency begins to color)*

The materials and suggestions are the same as those mentioned under the petal-fall spray (page 26).

For a dust, a 90–10 sulfur–lead-arsenate mixture is indicated. The applications are made at the same times as indicated for sprays; but, if there are heavy rains, extra dust applications should follow them.

Third fruit-fly spray for sour cherries

In some years, such as 1952 and 1953, a third application is needed 10 days after the second because of the late activity of the fruit-flies.

Parathion, at the rate of 2 pounds of 15 per cent powder, or methoxychlor, at the rate of 2 to 3 pounds of 50 per cent powder, may be substituted for the lead arsenate on a trial basis. Over the past two seasons

these materials have equalled lead arsenate in fruit-fly control in the tests at the Geneva station. These materials are of particular value on the Morello variety where arsenical dry-stem is more often a problem. Parathion and glyodin (Crag 341) should *not* be used together.

After-picking spray

(Soon after harvest)

The choice of fungicides given under the petal-fall spray (pages 26 and 27) applies for this application. The lead arsenate should be omitted.

For sour cherries to be used as fresh fruit

The schedule outlined for the **fruit-fly** sprays for sweet cherries should be followed.

FOR SWEET CHERRIES

Dormant spray for sweet cherries

(Before the buds are open)

The DNC sprays are effective for the control of **black cherry aphid.** Use 1½ quarts of a liquid or 1½ pounds of powdered DNC (Elgetol, Krenite, and the like) material in 100 gallons of water.

The newer DNBP materials (DN–289, Elgetol 318) may also be used at the rate of 1 quart in 100 gallons of spray.

Pre-blossom spray for sweet cherries

(Just before the blossoms open)

Lime-sulfur	2 gallons
Water to make	100 gallons
or	
Elemental-sulfur paste	10 pounds
Oil type of sticker	1 pint
Water to make	100 gallons
or	
Captan	2 pounds
Water to make	100 gallons

Promising results were obtained with captan against blossom blight in 1953. Buds appeared to be invigorated by this spray.

The pre-blossom spray is for control of **brown-rot blossom blight.** Additional sulfur applications in bloom may be needed. If no dormant spray was made for aphids, an application is needed at the green-tip stage. One pint of nicotine sulfate; from 3 to 5 pounds of potash fish-oil soap, 1 pound of soap flakes, or 3 pounds of spray lime may be added to the

lime-sulfur to spread and activate the nicotine. From ¼ to ½ pint of TEPP or 1 pound of parathion may be substituted for the nicotine sulfate in the elemental-sulfur formula.

Usually, the nicotine spray is not so effective as the dormant DN sprays for aphid control.

Petal-fall spray for sweet cherries
(for leaf spot, brown rot, and plum curculio)

Lime-sulfur	2 gallons
Lead arsenate	2½ pounds
Hydrated spray lime	2½ pounds
Water to make	100 gallons
or	
Elemental-sulfur paste	10 pounds
Oil type of sticker	1 pint
Lead arsenate	2½ pounds
Hydrated spray lime	2½ pounds
Water to make	100 gallons
or	
Elemental sulfur (actual sulfur)	3 pounds
Ferbam	1 pound
Lead arsenate	2½ pounds
Water to make	100 gallons

The addition of ½ pound of soybean flour improves the spreading qualities of the lime-sulfur–lead-arsenate mixture.

Copper sprays are unsafe for use on sweet cherries

Parathion or methoxychlor may be used in place of lead arsenate as indicated in the sour cherry schedule (page 28).

A mixture of 3 pounds of elemental sulfur and 1 pound of ferbam is a promising formula to control brown rot, botrytis rot, and leaf spot. Ferbam and sulfur sprays may be alternated for the same result.

Shuck spray for sweet cherries

(When the shucks are falling from the fruits which are going to set)

The materials are the same as those outlined for the petal-fall spray.

The shuck spray is effective against **leaf spot, brown rot,** and **curculio.**

Later sprays

(For cherry fruit flies, leaf spot, and brown rot)

During the past few years the black cherry aphid has frequently re-

quired summer control measures. Any one of the following sprays may be used:

(1) Tetraethyl pyrophosphate	¼ to ½	pint
Water to make	100	gallons
(2) Parathion	1	pound
Water to make	100	gallons
(3) Nicotine sulfate	1	pint
Soap chips	1	pound
Water to make	100	gallons

For sweet cherries to be used as fresh fruit

It is impossible to recommend a spray schedule that always gives satisfactory maggot control and at the same time insures freedom from spray residue. The following suggestions are offered:

First fruit-fly spray for sweet cherries

*(A week after the **fruit flies** first appear or about the time Early Richmond shows a tinge of color)*

Fine ground derris or cubé powder	2	pounds
(containing from 4 to 5 per cent of rotenone)		
Wettable sulfur at manufacturers' directions		
Water to make	100	gallons

Lime, bordeaux mixture, or lime-sulfur should not be used with derris or cubé powder. The paste forms of wettable sulfurs plus a sticker seem superior for this purpose.

Second fruit-fly spray for sweet cherries

*(About one week after the first **fruit-fly** spray)*

The formula is the same as that for the first fruit-fly spray.

Third fruit-fly spray for sweet cherries

*(About one week after the second **fruit-fly** spray)*

The formula is the same as that for the first fruit-fly spray.

For those growers who prefer to make only two **fruit-fly** sprays, it is advisable to use 3 pounds of derris or cubé powder to 100 gallons of spray instead of 2 pounds. Two applications may not give so satisfactory control as three, particularly if there are rain periods. Methoxychlor or parathion may be substituted for the derris on a trial basis if desired (page 28).

For processed sweet cherries that are to be washed

The schedule is the same as that outlined for sour cherries that are to be washed except that the lime-sulfur is reduced to 2 gallons. **Coppers are unsafe for sweet cherries.**

After-picking spray for sweet cherries

The schedule is the same as that outlined for sour cherries (page 29) except that only 2 gallons of lime-sulfur is used and that sulfurs rather than coppers are used for sweet cherries.

PEACH

In New York the peach suffers severely from **leaf-curl, brown rot,** and **scab** and, in certain localities, from the ravages of the **plum curculio.** The **oriental fruit moth** and **peach tree borers** have been major pests of peach and require suitable control measures. **Tarnished plant bug, European fruit lecanium,** and **cottony peach scale** are also important in some areas.

SPRAY OUTLINE

Leaf-curl spray

(After the leaves drop in the fall or in the spring before the buds swell)

*Lime-sulfur	6½ gallons
or	
DNC paste	½ gallon
or	
DNC dry wettable	2 pounds
or	
Ferbam	1½ pounds
Water to make	100 gallons

*If San José scale is present, 11 gallons of lime-sulfur should be used.

Bordeaux mixture may be used at 10–10–100 in the fall or 6–6–100 in the spring. Injury to peach buds has been reported from a late spring spray of 1 gallon of paste DNC (Elgetol).

The DNP materials (DN–289 and Elgetol 318) are not safe on peaches.

Pre-blossom spray

(When the blossoms show pink or a little earlier if a rain period threatens)

Lime-sulfur	2 gallons
Water to make	100 gallons
or	
Elemental sulfur at manufacturers' directions	
Water to make	100 gallons
or	
Captan	2 pounds
Water to make	100 gallons

This application is made to prevent **brown-rot blossom blight.**

If a dust schedule is followed, an application of dusting sulfur is indicated.

Where **tarnished plant bugs** (which "cat-face" the fruit) are a severe problems, 2 pounds of DDT (50 per cent wettable powder) should be included. DDT should *not* be applied during bloom.

SUMMER SPRAYS

Two basic schedules may be followed to control peach insects. Most growers have replaced lead arsenate with one of these schedules because of the serious injury frequently caused by lead-arsenate sprays. Schedule 1 involves the use of the phosphate materials, EPN or parathion, plus fungicide. It is designed to control all of the major pests of peach and a number of minor pests with the exception of the Japanese beetle. The number of sprays given here have been carefully determined by experimental workers at the Geneva station and represent the minimum number of sprays for a complete peach insect and disease control schedule. Schedule 2 is offered as second choice for those growers who prefer to use other than phosphate materials (page 35). Home orchardists are advised against the use of parathion or EPN.

Schedule 1

The following formula should be used in all sprays with the exception of the second fruit-moth spray.

EPN ..... 1¼ pounds
Elemental sulfur at manufacturers' directions

or

Parathion ..... 2 pounds
Elemental sulfur at manufacturers' directions
Water to make ..... 100 gallons

First curculio or shuck split spray

(When the first shucks are starting to split from the fruits that are going to set)

This spray is important for the control of **brown rot** and **plum curculio.** It also gives partial control of **tarnished plant bugs** where a problem.

The influence of temperature on effective control of the plum curculio is of great importance. Adults are active beginning at shuck split and for a period of 3 to 5 weeks thereafter, depending on area and the number of warm temperature periods. When temperatures of 70° to 75° F. are reached on 2 to 3 successive days, curculio adults become active. If such

temperatures are reached just prior to shuck split, then injury can be expected immediately after the fruits are exposed. In such an instance the wise grower is early with his insecticide rather than late. If there is a week of hot weather after shuck split, a 7-day interval is advised, especially where parathion is used. EPN has somewhat longer residual action than parathion and a longer interval appears to be permissible.

Dieldrin may be used in the curculio sprays at the rate of ½ pound of the 50 per cent powder. It does not protect against the oriental fruit moth and borers, however, and the overall program is materially weakened. Since it is more effective than EPN, parathion, or methoxychlor for the control of plum curculio, some growers with a severe curculio problem and low populations of borers or fruit moth might find it of advantage.

Second curculio spray

(From 7 to 10 days after shuck-split spray)

The second spray is important for **plum curculio** and **brown rot** as well as for **first-brood oriental fruit moth** and the **lesser peach tree borer.** Spray the trunks and scaffold limbs as well as the fruit and foliage.

Third curculio spray

(From 7 to 10 days after second curculio spray)

A third spray is necessary in eastern New York to continue protection against the **plum curculio.** It is also of value against **brown rot, oriental fruit moth,** and **lesser peach tree borer.**

First fruit-moth spray

(From July 7 to July 15)

This first fruit-moth spray provides protection against **oriental fruit moth, peach tree borers, cottony peach scale, European fruit lecanium scale,** and **brown rot.** The spray is applied to trunks and scaffold limbs as well as to the foliage and fruit for maximum results, and is directed to the undersides of the leaves where scale insects are a problem.

Where **cottony peach scale** or **lecanium scale** is a problem, you may have to adjust the time of application for maximum control. Parathion or EPN is effective for a period from about 10 days after the beginning of the summer hatch of the crawlers of either scale until completion of the hatch. Where both scales are a problem, a spray at the completion of the cottony peach scale hatch will normally give protection against both species.

Second fruit-moth spray

(From August 1 to August 10)

The second fruit-moth spray is important for **oriental fruit moth** and **peach tree borers.** Sprays applied at this time should have low enough residues to constitute no problem on varieties such as Golden Jubilee and those picked later than Jubilee.

Special sprays

A final treatment of elemental sulfur alone at manufacturers' directions should be made just before harvest.

Japanese beetle

As parathion or EPN lose their toxicity to the Japanese beetle within 3 to 5 days, special measures must be taken in areas where the beetle is a problem.

In the southern part of the Hudson Valley where **Japanese-beetle** infestations are heavy, fruit may require protection from mid-July to mid-August. Zinc dimethyldithiocarbamate (Ziram), 1½ pounds in 100 gallons of water, is a good repellent to **Japanese beetle** and may be substituted in place of the sulfur. If beetles attack the ripening fruit, make a preharvest rotenone spray or dust or a spray of Ziram. Further details are given in Cornell Extension Bulletin 770, *The Japanese Beetle,* available from the Mailing Room, New York State College of Agriculture, at Cornell University, Ithaca, New York.

Schedule 2

Schedule 2 involves the use of methoxychlor at the rate of 3 pounds in 100 gallons of spray in place of parathion or EPN in the curculio sprays. It protects against **plum curculio** and to some extent **tarnished plant bugs.** Apply DDT to the foliage and fruit to control the **oriental fruit moth** at the rate of 2 pounds in 100 gallons in two applications, the first about July 1 to 10, the second about July 14 to 24, followed by a third application of 1 pound of 50 per cent powder in an August 1 to August 10 spray. For control of **peach tree borer** the trunks and scaffold branches must be sprayed thoroughly with DDT at the rate of 3 pounds (50 per cent wettable powder) in 100 gallons. Two applications are made, beginning July 10 to 15 and followed in 21 days by a second treatment. Sulfur should be included in these sprays to control brown rot.

Control of the **lesser peach tree borer, cottony peach scale,** and **European fruit lecanium** is not possible with this summer schedule without using phosphate materials. For **scale insects,** a less effective alternative is available in the form of a dormant oil spray, using a 3 per cent concen-

tration of a superior type dormant oil. **Japanese beetle** will be adequately controlled in areas where it is a problem by the DDT program suggested for oriental fruit moth control. If **brown rot** is the only problem, sulfur sprays or dusts may be used, making the first application 2 or 3 weeks after the shucks have fallen, the second from 2 to 4 weeks before the fruit ripens, and a final application just before harvest.

PLUM AND PRUNE

THE main troubles for which commercial growers of plums and prunes find spraying necessary are **plum curculio, leaf spot,** and **brown rot.** In some plantings, **European red mite, European fruit lecanium, apple maggot,** and **black knot** may require special attention.

SPRAY OUTLINE

SPRING SPRAYS

Green-tip spray

(As the buds are breaking)

Bordeaux mixture	6–12–100
Water to make	100 gallons

or

Lime-sulfur	11 gallons
Water to make	100 gallons

If **black knot** is a serious problem, a green-tip spray should be made in addition to the regular shuck and summer sprays on plums and prunes. For the green-tip spray, both bordeaux and lime-sulfur have given good results.

If **bud moth** is a problem, 1 pint of nicotine sulfate or 1 pound of 15 per cent parathion should be included in the bordeaux formula above.

Pre-blossom spray

(Just before the blossoms open)

Lime-sulfur	2 gallons
Water to make	100 gallons

or

Elemental-sulfur paste	10 pounds
Oil type sticker	1 pint
Water to make	100 gallons

or

Captan	2 pounds
Water to make	100 gallons

This pre-blossom spray controls **brown-rot blossom-blight.**

First curculio spray

(When the shucks first start to split)

Elemental sulfur at manufacturers' directions
Parathion ..... 2 pounds
Water to make ..... 100 gallons

or

Elemental sulfur at manufacturers' directions
Methoxychlor ..... 3 pounds
Water to make ..... 100 gallons

The first formula is effective in checking **plum curculio, leaf spot, brown rot,** and **European red mites.** The second formula is of value for **plum curculio, leaf spot,** and **brown rot.** The remarks regarding temperatures given under the first curculio spray on peaches (page 33) also apply here. In orchards where curculio is a severe problem, dieldrin may be substituted for parathion or methoxychlor on a trial basis at the rate of ½ pound of the 50 per cent powder.

Second curculio spray

(From 7 to 10 days after the first curculio spray)

The same choice of materials may be made as in the first curculio spray.

Third curculio spray

(From 7 to 10 days after the second curculio spray)

A third spray is necessary in eastern New York to control **plum curculio.** In seasons of extended activity of plum curculio, the third curculio spray may be needed in western New York and a fourth spray may be necessary in eastern New York, using the same materials and timing. The local county agent or Spray Information Service letter give the details.

Where **lecanium scale** is a problem, a spray using the parathion formula should be applied from 16 to 20 days after the second curculio spray. In other words, at the completion of scale hatch. The undersides of the leaves must be thoroughly covered.

Later sprays

(Two or three weeks before the fruit ripens)

Elemental sulfur at manufacturers' directions
Water to make ..... 100 gallons

The applications control **brown rot** and **leaf spot.**

For a dust schedule, applications of dusting sulfur are indicated.

In some orchards, the red-banded leaf roller builds up in sufficient

numbers to require control measures. Where parathion or EPN is used in the curculio spray, the first brood will be adequately controlled. Where methoxychlor or dieldrin is used, 1 pound of 50 per cent DDD powder should be added in the second curculio spray. For second brood control, DDD is used at the rate of 2 pounds of powder during the first week in August. Where DDT is being used for apple maggot control, the DDD may be substituted for DDT. Parathion at the rate of 1½ pounds of the 15 per cent powder is another effective material for the control of leaf roller and also for orchard mites and bud moth.

If **red mite** or **two-spotted mite** become a problem, tetraethyl pyrophosphate may be used at manufacturers' directions or parathion at 1 pound of 15 per cent powder or EPN at ½ pound in 100 gallons. Two applications from 7 to 10 days apart are necessary.

In some orchards, the **apple maggot** causes considerable damage to prunes. In orchards not surrounded or bordered by unsprayed trees, the maggot may be controlled with three to four applications of DDT. Applications of DDT, 2 pounds of 50 per cent wettable powder in 100 gallons of water, should be started about June 20 in eastern New York and about July 1 in western New York and applied at 10-day intervals.

QUINCE

FORTUNATELY, the quince is subject to attack by only a comparatively small number of insects and diseases. In the past the most serious insect enemy has been the **quince curculio,** but the **oriental fruit moth** is now much more destructive. The **red-banded leaf roller** has also caused considerable losses in recent years. Among diseases subject to control by spraying, the most important is **leaf-blight** and **fruit spot;** occasionally the **Brooks fruit spot** may cause serious losses.

SPRAYING OUTLINE

SPRING SPRAYS

Dormant spray

(In the spring before the buds start)

Dormant-type oil emulsion, diluted to contain 3 per cent of oil.

Apply this when **lecanium scale** becomes abundant, or for **European red mite.** Summer measures as discussed under peaches and prunes may be used if this spray is omitted.

Pink spray

(When the blossoms show pink)

Lime-sulfur ..... 2½ gallons
Water to make ..... 100 gallons

or

3–8–100 bordeaux mixture

or

Ferbam ..... 1½ pounds

or

Elemental sulfur (actual sulfur) ..... 5 pounds

The lime-sulfur gives good control but often causes considerable spray injury. Bordeaux mixture gives excellent control of **leaf-blight** and **fruit spot** but fruit and leaf injury may be severe. Ferbam gives good disease control and sulfur gives fair control. Neither causes spray injury at this time.

Petal-fall spray

(When 90 per cent of the petals have started to wither)

Bordeaux mixture 3–8–100

or

Ferbam ..... 1½ pounds

or

Elemental sulfur (actual sulfur) ..... 5 pounds
DDT ..... 2 pounds
Water to make ..... 100 gallons

This spray controls **leaf-blight, leaf spot, codling moth,** and **oriental fruit moth.**

If **plum curculio** is a problem, 2 pounds of lead arsenate may be added to the formula.

Lime-sulfur should not be used with DDT. When lead arsenate and lime-sulfur are used, 1 pound of lime is added for each pound of lead arsenate.

LATER SPRAYS

The same formula as suggested in the petal-fall spray is advised except that sulfur is not suggested after the petal-fall spray.

The first application is made 10 days after the petal-fall spray. This spray controls **leaf spot, leaf-blight,** and **oriental fruit moth.** If **quince curculio** is a problem, 3 pounds of lead arsenate is added to the formula.

Two applications after the petal-fall spray are usually enough to control **leaf spot, leaf-blight,** and **quince curculio.**

For the control of **oriental fruit moth** with DDT, from three to four more applications should follow the 10-day spray at 19- to 21-day intervals.

DDD (TDE) may be used in place of DDT during the first two weeks in August at the rate of 2 pounds of 50 per cent powder in 100 gallons of spray to control **red-banded leaf roller.** The DDD should provide enough protection against **oriental fruit moth** without the addition of DDT.

SAFETY WITH INSECTICIDES

THE organic phosphate materials, parathion, EPN, and TEPP, are highly poisonous to man if improperly used. The following precautions should be followed when using these materials. In addition, all chemical poisons should be treated with respect.

1. The greatest danger from parathion or EPN wettable powder appears to be in the operation of putting the wettable powder from the bag or can into the spray tank. Be careful at this point.
2. Wear a respirator with a filter for powders and an activated charcoal filter for organic vapors.
3. Wear natural rubber gloves.
4. Protect the body from wettable powder and from spray drift. Wear rubber or plastic coats or wash your clothes every day.
5. Symptoms of poisoning: headache, nausea, pin-point vision, constriction of the chest.
6. If the above symptoms are experienced, do not delay – see your doctor. The antidote is atropine sulphate and cannot be obtained without a doctor's prescription. It is wise to have atropine sulphate on hand. If symptoms are experienced, take no more than 2 tablets and then **see your doctor.**
7. Never thin and remove suckers until several days after phosphate applications. Handling insecticides safely is similar to driving an automobile or, handling fire. If certain precautions are followed, these useful instruments and materials can be used to advantage. If misused, they can do serious harm.

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